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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/511,743	04/18/2005	Adrian Boyle	37389-403300	4959

27717 7590 12/11/2008

SEYFARTH SHAW LLP
131 S. DEARBORN ST., SUITE 2400
CHICAGO, IL 60603-5803

EXAMINER	
KLEIN, JORDAN M	

ART UNIT	PAPER NUMBER
4176	

MAIL DATE	DELIVERY MODE
12/11/2008	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/511,743	BOYLE ET AL.	
	Examiner	Art Unit	
	JORDAN KLEIN	4176	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *18 October 2004*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-50* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-50* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *18 October 2004* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *18 October 2004*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

This Office Action is in response to the Applicant's communication filed on October 18th, 2004. In virtue of the communication, claims 1-50 are currently presented in the instant application.

Priority

1. Receipt is acknowledged of papers submitted under 35 U.S.C. 119(a)-(d), which papers have been placed of record in the file.

Information Disclosure Statement

2. The information disclosure statement filed October 10th, 2004 fails to comply with 37 CFR 1.98(a)(2), which requires a legible copy of each cited foreign patent document; each non-patent literature publication or that portion which caused it to be listed; and all other information or that portion which caused it to be listed. It has been placed in the application file, but the information referred to therein has not been considered.

Claim Objections

3. Claim 48 is objected to because of the following informalities: Claim 48 should be reworded. One suggestion would read "An apparatus as claimed in claim 33, arranged for a substrate mounted on a tape, wherein the laser is controlled in final scans of the substrate **so as to** not substantially damage the tape."

Appropriate correction is required.

Claim Rejections - 35 USC § 102

4. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the

basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

5. Claims 1, 2, 4-18, 20-28, 33-37, 39-46 are rejected under 35 U.S.C. 102(e) as being anticipated by Boyle et al. (U.S. Patent No. 6,586,707; hereinafter referred to as Boyle).

The applied reference has a common assignee with the instant application. Based upon the earlier effective U.S. filing date of the reference, it constitutes prior art under 35 U.S.C. 102(e). This rejection under 35 U.S.C. 102(e) might be overcome either by a showing under 37 CFR 1.132 that any invention disclosed but not claimed in the reference was derived from the inventor of this application and is thus not the invention "by another," or by an appropriate showing under 37 CFR 1.131.

With respect to claim 1, Boyle discloses a pulsed laser [see column 2, line 17] for program-controlled [see column 5, line 14,15] dicing of a substrate [see column 5, line 48,49] comprising at least one layer [see fig. 1 (it is implicitly understood that the wafer has at least one layer)], the method comprising the steps of:

a. providing program control means and associated data storage means [see column 5, line 14,15] for controlling the pulsed laser [see column 1, line 59,60];

b. providing in the associated data storage means a laser cutting strategy file [see column 5, line 48,49 (referred to as the machining strategy)] of at least one selected combination of pulse rate, pulse energy and pulse spatial overlap [see column 2, line 38-40 (referred to as scan velocity, laser power, and pulse overlap respectively)] of pulses produced by the laser at the substrate to

restrict damage to the respective at least one layer while maximising machining rate for the at least one layer [see column 5, line 41-45];

c. providing in the laser cutting strategy file data representative of at least one selected plurality of scans of the respective at least one layer by the pulsed laser necessary to cut through the respective at least one layer when the pulsed laser is operating according to the respective at least one combination stored in the laser cutting strategy file; [see column 5, line 45-58] and

d. using the laser under control of the program control means driven by the laser cutting strategy file [see column 5, line 14,15] to scan the at least one layer with the respective at least one selected plurality of scans [see column 3, line 19,20] at least to facilitate dicing of the substrate [see column 2, line 48,49] such that a resultant die has at least a predetermined die strength [see column 5, line 44 (it is understood that this implicitly discloses predetermined die strength)] and a yield of operational die equals at least a predetermined minimum yield [see column 1, line 15 and column 1, line 48,49 (it is understood that this implicitly discloses predetermined minimum yield)].

With respect to claim 2, Boyle discloses all of the limitations of claim 1, further comprising the steps of providing a laser cutting strategy file comprise, for each of the at least one layer, the steps of:

b1. varying at least one of a combination of pulse rate, pulse energy, pulse spatial overlap to provide a respective combination [see column 8, line 5-7 (referred to as parameters)];

b2. measuring a cutting rate of the respective layer using the respective combination [see Fig. 6 and column 3, line 63,64];

b3. examining the layer to determine whether damage is restricted to a predetermined extent [see column 5, line 11,12];

b4. dicing the substrate and measuring yield of the resultant die [see column 2, line 48,49 (it is understood that this implicitly discloses measuring yield of the resultant die)];

b5. measuring die strength of the resultant die [see column 5, line 46 (it is understood that this implicitly discloses measuring die strength of the resultant die)];

b6. creating a laser cutting strategy file of a selected combination which maximises cutting rate while resulting in a yield of operational die which have at least the predetermined minimum yield and for which the die have at least the predetermined die strength [see column 5, line 46-51 (it is understood that this implicitly discloses the predetermined minimum yield and die strength)];

c 1. scanning the at least one layer using the selected combination to determine a plurality of scans necessary to cut through the layer [see column 7, line 54-65]; and

c2. storing the selected plurality of scans in the laser cutting strategy file [see column 5, line 48,49].

With respect to claim 4, Boyle discloses all of the limitations of claim 1, wherein the step d of using the laser to scan the at least one layer includes providing a galvanometer-based scanner [see column 4, line 33-35].

With respect to claim 5, Boyle discloses all of the limitations of claim 1 wherein the step d of using the laser to scan the at least one layer includes providing a telecentric scan lens for scanning a laser beam from the laser across the substrate and the step of providing a laser cutting strategy file [see column 4, line 64-66] comprises the steps of;

d1. mapping a laser energy density received in a focal plane of the telecentric scan lens to produce a laser energy density map of a field of view of the telecentric lens [see column 2, line 66-column 3, line 4] using the selected combination of pulse rate, pulse energy and pulse spatial overlap of pulses [see column 2, line 38-40];

d2. storing the laser energy density map as an array in the storage means [see column 5, line 14,15; column 6, line 60-67] ; and

d3. using the laser energy density map to modify, with the control means, at least one of the pulse repetition rate and the pulse energy of the selected combination to produce a constant laser energy density at scanned points in the field of view at the substrate [see column 3, line 17; column 5, line 14,15; column 6, line 60-67].

With respect to claim 6, Boyle discloses all of the limitations of claim 1 and 5, wherein the step of mapping a laser energy density comprises using a laser power meter [see Fig. 6 (it is understood that a laser power meter is implicitly disclosed)] to measure laser energy density at representative locations within the field of view of the telecentric lens [see column 8, line 66,67-column 9, line 1-3 and Fig. 6].

With respect to claim 7, Boyle discloses all of the limitations of claim 1, wherein the step of providing a selected combination comprises providing a selected combination which restricts thermal loading of the material of the respective layer to restrict mechanical stress to a predetermined maximum [see column 5, line 41-49].

With respect to claim 8, Boyle discloses all of the limitations of claim 1, wherein the selected combination is used for less than the selected plurality of scans, which corresponds to

the selected combination, to machine a layer to be cut and the layer is scanned for further scans up to the selected plurality using a combination [see column 2, line 14-17] which will not significantly machine an underlying layer such that substantially no machining occurs of the underlying layer should the laser continue to scan the substrate after the layer to be cut has been cut through [see column 10, line 28-30 (it is understood that this is implicitly disclosed)].

With respect to claim 9, Boyle discloses all of the limitations of claim 1 and claim 8, wherein the method as claimed in claim 8 is used for scribing a substrate through the layer to be cut for subsequent mechanical dicing of the substrate [see column 5, line 19-22 and Fig. 2].

With respect to claim 10, Boyle discloses all of the limitations of claim 1, wherein the substrate includes an active layer [see column 11, line 9 (referred to as active materials on the wafer surface)], wherein the step of providing a selected combination to restrict damage to the at least one layer comprises providing a selected combination which does not significantly affect the subsequent operation of active devices in the active layer [see column 5, line 59-63 (it is understood that this implicitly includes the active layer as part of the resultant wafer)].

With respect to claim 11, Boyle discloses all of the limitations of claim 1 and claim 10, wherein the step of providing a selected combination which does not significantly affect the subsequent operation of active devices in the active layer comprises providing a combination which does not cause significant cracks to propagate through the active layer [see column 5, line 46-51 (it is understood that this implicitly includes the active layer as part of the wafer)].

With respect to claim 12, Boyle discloses all of the limitations of claim 1, wherein the step of providing a selected combination comprises the steps of:

b7. providing an initial combination at which the laser machines the substrate at an initial rate which does not cause significant crack propagation due to thermal shock at an ambient temperature [see column 5, line 46-51], and such that a temperature of the substrate is raised by the machining after a predetermined plurality of scans of the substrate by the laser to a raised temperature above ambient temperature [see column 8, line 45-47];

b8. and providing a working combination at which the laser machines the substrate at a working rate, higher than the initial rate, [see column 5, line 59-63] which does not cause significant crack propagation due to thermal shock at the raised temperature [see column 5, line 46-51];

and step d of machining the substrate includes:

d4. machining an initial depth of the substrate using the initial combination for at least the predetermined plurality of scans [see column 3, line 19,20]; and

d5. machining at least part of a remaining depth of the substrate using the working combination [see column 8, line 5-7].

With respect to claim 13, Boyle discloses all of the limitations of claim 1, wherein an energy of at least a first of the plurality of scans is lower than an energy of succeeding scans of the plurality of scans such that a generation of surface micro-cracks is less than would otherwise be produced [see column 8, line 5-7].

With respect to claim 14, Boyle discloses all of the limitations of claim 1, wherein an energy of at least a final of the plurality of scans is lower than an energy of preceding scans of the plurality of scans such that backside chipping of the substrate is less than would otherwise be produced [see column 8, line 5-7].

With respect to claim 15, Boyle discloses all of the limitations of claim 1, wherein energy

of the plurality of scans is varied between scans to facilitate removal of debris generated during dicing of the substrate, conveniently by increasing laser energy with increasing machining depth to remove debris for a dice lane [see column 5, line 24-30].

With respect to claim 16, Boyle discloses all of the limitations of claim 1, including the further steps of:

e. providing gas handling means to provide a gaseous environment for the substrate [see column 3, line 8-12];

f. using the gaseous environment to control a chemical reaction with the substrate at least one of prior to and during dicing the substrate [see column 10, line 51-57] to enhance a strength of the resultant die [see column 1, line 43,44 (it is understood that this implicitly discloses enhancement of the strength of the resultant die)].

With respect to claim 17, Boyle discloses all of the limitations of claim 1 and claim 16, wherein the step of providing gas handling means includes providing gas delivery head means for delivering gas substantially uniformly to a cutting region of the substrate to facilitate substantially uniform cutting of the substrate [see column 3, line 8-12 (it is understood that this implicitly discloses substantially uniform cutting of the substrate)].

With respect to claim 18, Boyle discloses all of the limitations of claim 1 and claim 16, wherein the step of providing gas handling means comprises providing means to control at least one of flow rate, concentration, temperature, type of gas and a mixture of types of gases [see column 11, line 23-25].

With respect to claim 20, Boyle discloses all of the limitations of claim 1 and claim 16, wherein the step of providing a gaseous environment comprises providing an active gas

environment [see column 3, line 31-33].

With respect to claim 21, Boyle discloses all of the limitations of claims 1, 16 and 20, wherein the step of providing an active gas environment comprises etching walls of a die with the active gas to reduce surface roughness of the walls [see column 4, line 49-56] and thereby improve the die strength [see column 1, line 43,44 (it is understood that this implicitly discloses an improvement to the die strength)].

With respect to claim 22, Boyle discloses all of the limitations of claims 1, 16, and 20, wherein the step of providing an active gas environment comprises etching walls of a die with the active gas substantially to remove a heat affected zone produced during machining [see column 4, line 49-56 (it is understood that this implicitly discloses removal of heat to the affected zone], and thereby improve the die strength [see column 1, line 43,44 (it is understood that this implicitly discloses an improvement to the die strength)].

With respect to claim 23, Boyle discloses all of the limitations of claims 1, 16, and 20, wherein the step of providing an active gas environment comprises reducing debris, produced during machining, adhering to surfaces of machined die [see column 11, line 10- 16].

With respect to claim 24, Boyle discloses all of the limitations of claim 1, comprising the further step after dicing of scanning an edge of the resultant die with the laser with sufficient energy to heat sidewalls of the resultant die to reduce surface roughness thereof and thereby increase die strength of the resultant die [see column 11, line 52,53].

With respect to claim 25, Boyle discloses all of the limitations of claim 1, for producing die with rounded comers by scanning the laser beam along a curved trajectory at comers of the die using a galvanometer based scanner, wherein the selected combination is adapted to maintain

the selected pulse spatial overlap between consecutive laser pulses around an entire circumference of the die [see column 4, line 30-35].

With respect to claim 26, Boyle discloses all of the limitations of claim 1, wherein the selected combination is adapted to deliver pulses at an arcuate portion or comer of the die such that substantially no over-cutting or undercutting generating a defect at the arcuate die edge or corner occurs [see column 4, line 30-35 and column 5, line 59-63 (it is understood that this implicitly discloses no over-cutting or undercutting].

With respect to claim 27, Boyle discloses all of the limitations of claim 1, to form a tapered dice lane having arcuate walls tapering inwards in a direction away from the laser beam by varying a width of the dice lane as the laser scans through the substrate wherein the selected combination is modified to give a finely controlled taper and smooth die sidewalls, and thereby increase die strength of the resultant die [see column 9, line 23-33 (it is implicitly understood that providing a tapered structure to the die sidewalls would increase the die strength)].

With respect to claim 28, Boyle discloses all of the limitations of claim 1, wherein the laser is a Q-switched laser device [see column 7, line 1-3].

With respect to claim 33, Boyle discloses a program-controlled [see column 5, line 14,15] substrate dicing apparatus for dicing a substrate [see column 2, line 48,48] comprising at least one layer [see Fig. 1 (it is implicitly understood that the wafer has at least one layer)], the apparatus comprising: a pulsed laser [see column 2, line 17]; program control means and associated data storage means [see column 5, line 14,15] for controlling the pulsed laser [see column 2, line 59,60] using a laser cutting strategy file [see column 5, line 48,49 (referred to as the machining strategy)], stored in the data storage means [see column 5, line 14,15], of at least

one respective selected combination of pulse rate, pulse energy and pulse spatial overlap of pulses produced by the laser at the substrate [see column 2, line 38,39 (referred to as scan velocity, laser power, and pulse overlap respectively)] and data representative of at least one respective selected plurality of scans of the respective at least one layer by the pulsed laser necessary to cut through the respective at least one layer [see column 5, line 46-58]; telecentric scan lens means for scanning a laser beam from the pulsed laser across the substrate [see column 4, line 64-66]; and laser power measuring means [see Fig. 6 (it is understood that a laser power measuring means is implicitly disclosed)] for mapping a laser energy density received in a focal plane of the telecentric scan lens to produce a laser energy density map of a field of view of the telecentric lens [see column 3, line 66-column 3, line 4] using the selected combination of pulse rate, pulse energy and pulse spatial overlap of pulses [see column 2, line 38,39] for storing the laser energy density map as an array in the data storage means [see column 5, line 14,15; column 6, line 60-67] for modifying the at least one respective selected combination to compensate for irregularities, introduced by the telecentric lens, of laser energy density at the substrate [see column 6, line 45,46], such that in use a resultant die has at least a predetermined die strength [see column 5, line 44 (it is understood that this implicitly discloses predetermined die strength)] and a yield of operational die equals at least a predetermined minimum yield [see column 1, line 15, and column 1, line 48,49 (it is understood that this implicitly discloses predetermined minimum yield)].

With respect to claim 34, Boyle discloses all of the limitations of claim 33, wherein the program control means includes control means for varying at least one of pulse rate, pulse energy and pulse spatial overlap for controlling the laser subject to the at least one respective selected

combination [see column 2, line 38,39].

With respect to claim 35, Boyle discloses all of the limitations of claim 33, further comprising gas handling means for providing a gaseous environment for the substrate [see column 3, line 8-12] for controlling a chemical reaction with the substrate at least one of prior to and during dicing the substrate [see column 10, line 49-57] to enhance strength of the resultant die [see column 1, line 43,44 (it is understood that this implicitly discloses enhancement of the strength of the resultant die)].

With respect to claim 36, Boyle discloses all of the limitations of claim 33 and claim 35, wherein the gas handling means includes gas delivery head means for uniformly delivering gas to a cutting region of the substrate [see column 3, line 8-12].

With respect to claim 37, Boyle discloses all of the limitations of claim 33 and claim 35, wherein the gas handling means comprises control means for controlling at least one of flow rate, concentration, temperature, type of gas and a mixture of types of gases [see column 11, line 23-25].

With respect to claim 39, Boyle discloses all of the limitations of claim 33 and claim 35, wherein the gas handling means is arranged to provide an active gas environment [see column 3, line 31-33].

With respect to claim 40, Boyle discloses all of the limitations of claims 33, 35, and 39, wherein the gas handling means is arranged to etch walls of a die with the active gas to reduce surface roughness of the walls [see column 4, line 49-56], and thereby increase die strength [see column 1, line 43,44 (it is understood that this implicitly discloses an increase in die strength)].

With respect to claim 41, Boyle discloses all of the limitations of claims 33, 35, and 39,

wherein the gas handling means is arranged to etch walls of a die with the active gas substantially to remove a heat affected zone produced during machining [see column 4, line 49-56 (it is understood that this implicitly discloses removal of heat to the affected zone], and thereby increase die strength [see column 1, line 43,44 (it is understood that this implicitly discloses an increase in die strength)].

With respect to claim 42, Boyle discloses all of the limitations of claims 33, 35, and 39, wherein the gas handling means is arranged to etch walls of a die with the active gas to reduce debris, produced during machining, adhering to surfaces of machined die [see column 11, line page 22, line 8-10].

With respect to claim 43, Boyle discloses all of the limitations of claim 33, further comprising a galvanometer-based scanner for producing die with rounded comers by scanning a laser beam along a curved trajectory at comers of the die, wherein the selected combination is arranged to maintain the selected pulse spatial overlap between consecutive laser pulses around an entire circumference of the die [see column 4, line 30-35].

With respect to claim 44, Boyle discloses all of the limitations of claim 33, wherein the selected combination is arranged to control laser pulse delivery at an arcuate portion or comer of a die edge such that substantially no over-cutting or undercutting occurs which would generate a defect at the die edge [see column 4, line 30-35 and column 5, line 59-63 (it is understood that this implicitly discloses no over-cutting or undercutting].

With respect to claim 45, Boyle discloses all of the limitations of claim 33, arranged for forming a tapered dice lane having arcuate walls tapering inwards in a direction away from the laser beam by varying a width of the dice lane as the laser scans through the substrate wherein

the selected combination is modified to give a finely controlled taper with smooth die walls, and thereby increase die strength of the resultant die [see column 9, line 23-33 (it is implicitly understood that providing a tapered structure to the die sidewalls would increase the die strength)].

With respect to claim 46, Boyle discloses all of the limitations of claim 33, wherein the laser is a Q-switched laser device [see column 7, line 1-3].

Claim Rejections - 35 USC § 103

6. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

7. Claim 3 is rejected under 35 U.S.C. 103(a) as being unpatentable over Boyle (U.S. Patent No. 6,586,707) in view of Nakazawa et al. (U.S. Patent Application Publication 2002/0019074 A1; hereinafter referred to as Nakazawa).

With respect to claim 3, Boyle discloses that the die strength is measured [see column 5, line 44 (it is understood that this implicitly discloses measuring die strength)].

Boyle does not disclose that the die strength is measured using a Weibull die strength test.

Nakazawa teaches wherein the die strength is measured using a Weibull die strength test [see page 2, paragraph 0033 and Fig. 15A & B].

It would have been obvious to one of ordinary skill in the art at the time of the invention to modify the laser machining method of Boyle by employing the Weibull die strength test to measure die strength as taught by Nakazawa so as to improve the flexural strength of die as compared to conventional devices and methods [see page 5, paragraph 0069].

1. Claims 19 and 38 are rejected under 35 U.S.C. 103(a) as being unpatentable over Boyle (U.S. Patent No. 6,586,707) in view of Gruzman et al (U.S. Patent No. 4,639,572; hereinafter referred to as Gruzman).

With respect to claims 19 and 38, Boyle discloses all of the limitations of claims 1, and 16 as well as 33 and 35, wherein a gas handling means is provided [see column 3, line 8-12 and Figs. 14,15].

Boyle does not disclose wherein the step of providing a gaseous environment comprises providing a passive inert gas environment for substantially preventing oxidation of walls of a die during machining nor does Boyle discloses wherein the gas handling means is arranged to provide an inert gas environment for substantially preventing oxidation of walls of a die during machining.

Gruzman teaches that the step of providing a gaseous environment comprises providing a

passive inert gas environment for substantially preventing oxidation of walls of a die during machining and at the same time discloses that the gas handling means is arranged to provide an inert gas environment for substantially preventing oxidation of walls of a die during machining [see column 1, line 9-11 and column 2, line 46-58].

It would have been obvious to one of ordinary skill in the art at the time the inventions was made to modify the laser machining method and apparatus of Boyle by employing a passive inert gas environment to the walls of the die during machining as taught by Gruzman so as to prevent oxidation thereof.

8. Claims 29 and 47 are rejected under 35 U.S.C. 103(a) as being unpatentable over Boyle (U.S. Patent No. 6,586,707) in view of Yoo et al (U.S. Patent No. 6,130,401; hereinafter referred to as Yoo).

With respect to claims 29 and 47, Boyle discloses all of the limitations of claims 1 and 33 respectively, wherein a laser beam is directed by mirrors [see column 4, line 59].

Boyle does not disclose that a laser beam from the laser is directed by rotatable mirrors and furthermore does not disclose that the rotatable mirrors are used for directing a laser beam from the laser on the substrate.

Yoo teaches wherein a laser beam from the laser is directed by rotatable mirrors and furthermore that the rotatable mirrors are used for directing a laser beam from the laser on the substrate [see column 4, line 62-64, column 5, line 12-15 and Fig. 7].

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the laser machining method and apparatus of Boyle by employing the rotatable mirrors as taught by Yoo so as to allow the laser beam to be directed to cut a workpiece

[see column 4, line 62-62 and Fig. 7].

Claims 30-32 and 48-50 are rejected under 35 U.S.C. 103(a) as being unpatentable over Boyle (U.S. Patent No. 6,586,707) in view of Yamanaka (U.S. Patent No. 5,358,590).

With respect to claims 30-32 and 48-50, Boyle discloses all of the limitations of claims 1 and 33 respectively, wherein that the substrate is mounted [see column 10, line 58,59] and that energy of final scans of the laser is controlled substantially to prevent damage [see column 8, line 5-7 (it is understood that this implicitly discloses the prevention of damage)].

Boyle does not disclose wherein the substrate is mounted on a tape or that the tape is substantially transparent to ultraviolet radiation or that the tape is polyolefin-based.

Yamanaka teaches wherein the substrate is mounted on a tape and that the tape is substantially transparent to ultraviolet radiation and that the tape is polyolefin-based [see column 4, line 27-31].

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the laser machining method and apparatus of Boyle by employing the mounting tape that is transparent to ultraviolet radiation and is polyolefin-based as taught by Yamanaka so as to protect the wafer during the cutting process [see column 2, line 53-55] and to allow the tape to be easily peeled from the wafer after the irradiation with ultraviolet rays [see column 5, line 34-36]

Citation of Pertinent Prior Art

9. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Prior art Imoto et al. (U.S. Patent No. 5,916,460) discloses a method and apparatus for dicing a substrate using a laser.

Prior art O'Brien et al. (U.S. Patent No. 6,676,878 B2) discloses a method of using a laser for segmented cutting using a UV laser.

Prior art Sawada (U.S. Patent No. 6,770,544 B2) discloses a substrate cutting method using an ultra short pulse laser.

Prior art Duignan (U.S. Patent No. 6,792,326 B1) discloses a material delivery system for miniature structure fabrication.

Prior art Gottfried et al. (U.S. Patent No. 6,902,990 B2) discloses a method of semiconductor device separation using a patterned laser projection system.

Inquiry

Any inquiry concerning this communication or earlier communications from the examiner should be directed to JORDAN KLEIN whose telephone number is (571)270-7544. The examiner can normally be reached on Monday - Friday 7:30 to 5:00 with alternate Fridays off.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, THUY TRAN can be reached on (571)-272-1828. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR

system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

JMK
December 4th, 2008

/Thuy Vinh Tran/
Supervisory Patent Examiner, Art Unit 4176